TEE because of artifacts. In urgent circumstances, even if the need to minimize delay appears to justify the desire to reduce the number of studies, reliable information is mandatory. We therefore believe that only highly accurate techniques such as multiplanar TEE should be employed in diagnosing aortic dissections.

REFERENCES

1. Wiet SP, Pearce WH, McCarty WJ, Joob AW, Yao JS, McPhearson DD. Utility of transesophageal echocardiography in the diagnosis of disease of the thoracic aorta. J Vasc Surg 1994;20:613-20.
2. Evangelista A, Gonzalez-Alujas T, Garcia-del Castillo H, Anivarro I, Salas J, Soler-Soler J. Are artifacts a major drawback for the diagnosis of ascending aortic dissection by transoesophageal echocardiography? Eur Heart J 1993; 14(Suppl):391.
3. Banning AP, Masani ND, Ikram S, Fraser AG, Hall RC. Transoesophageal echocardiography as the sole diagnostic investigation in patients with suspected thoracic aortic dissection. Br Heart J 1994;72:461-5.
4. Hirst AE, Johns VJ, Kime SW. Dissecting aneurysm of the aorta: a review of 505 cases. Medicine 1958;37:217-79.

STENTED ELEPHANT TRUNK PROCEDURE FOR AN EXTENSIVE ANEURYSM INVOLVING DISTAL AORTIC ARCH AND DESCENDING AORTA

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Replacement of extensive portions of the aorta remains a formidable task, especially in patients with poor risk conditions and those with pulmonary disease. In this article, we present a successful single-stage replacement of the arch and descending aorta through sternotomy with the "stented" elephant trunk procedure in a patient at high risk.

A 71-year-old woman, who had undergone prosthetic graft replacement because of a thoracoabdominal aortic aneurysm 6 years previously, was admitted to the hospital because of an extensive aneurysm involving distal aortic arch and descending aorta. Computed tomography showed that the aneurysm was enlarged to 72 mm in diameter and was extended to 3 cm above the proximal anastomosis of the previous prosthetic graft. Because severe pleural adhesion caused by old tuberculosis was found at previous operation, we decided to operate through a median sternotomy without entering the left pleural space. For this purpose, the elephant trunk technique[1] was used and the distal end of the trunk was fixed with a stent under endoscopic guidance.

Operative procedure. The ascending aorta and the aortic arch were exposed through a median sternotomy. Cardiopulmonary bypass was established by ascending aortic and bicaval cannulations. The patient was cooled to a rectal temperature of 20° C. Cardiac arrest was obtained with ascending aortic crossclamping and antegrade and retrograde cold blood cardioplegic solution. Under selective cerebral perfusion and systemic circulatory arrest, the aortic arch was transected just proximal to the aneurysm at the level of the origin of the left subclavian artery. A Gianturco stent (Cook, Bloomington, Ind.), 40 mm in diameter and 50 mm in length, was inserted and fixed to a 30 mm collagen-coated woven Dacron graft, and an endoscope was inserted through it. This combined graft was constricted by three purse-string sutures. Under endoscopic guidance, the combined graft was inserted into the aneurysm as an elephant trunk prosthesis. The distal end of the graft was located 3 cm above the proximal anastomotic site of the previous graft to preserve the intercostal flow, which was identified with the endoscope at 2 cm above the proximal anastomosis. Dense mural thrombus was present in the aneurysm, and no other patent intercostal and bronchial artery was identified. The length of the trunk was about 10 cm. The stent was then expanded by releasing the purse strings to fix the distal end of the trunk.

The proximal portion of the graft was anastomosed to the aortic stump (Fig. 1, *A*), and the invaginated portion of the graft was pulled out. Subsequently, total arch replacement was done with 24 mm gelatin-coated knitted Dacron fabric with four branches. First the branched graft was connected to the elephant trunk, and systemic reperfusion and rewarming were started through the fourth branch. Then the branched graft was anastomosed to the native ascending aorta, and the ascending aorta was unclamped for coronary reperfusion. Finally three arch vessels were sutured end to end to the branch grafts (Fig. 1, *B*). The patient was weaned from bypass without problems. The postoperative course was uneventful. Angiography undertaken 4 weeks after operation indicated adequate expansion of the stent and no blood flow around the graft (Fig. 2).

Discussion. Since Borst, Walterbusch, and Schaps[1] introduced the elephant trunk technique in 1983 this technique has been widely used for staged aortic replacement.[2-4] In addition, these investigators reported one case

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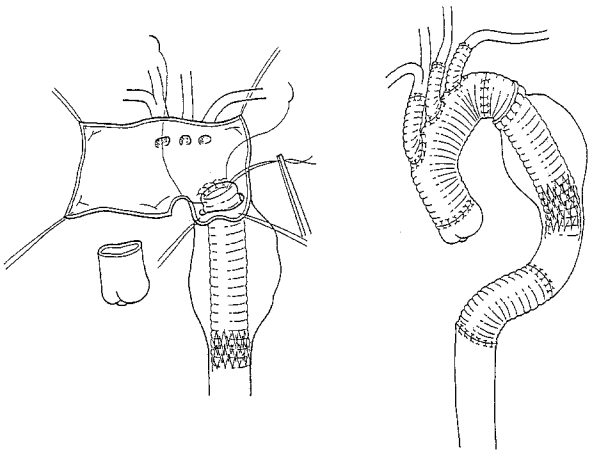

Fig. 1. Schematic drawing of operation. See text for details.

in which the dead space around the long elephant trunk was filled with clot and further operation was not needed.[2] The authors highlighted this phenomenon as a further potential use of this technique. Crawford and associates[3] reported complications of this method: kinking and occlusion of the graft, paraplegia as a result of clot around the graft, and peripheral thromboembolism caused by flapping action. They stated that these complications were more likely when the trunk was longer.

To avoid these potential complications of a long elephant trunk graft, we used a stent at the distal end to fix the graft to the native aortic wall. By this method, we could prevent any kinking and flapping action of the graft. In addition, we can expect complete obliteration of the dead space around the graft even if there are patent intercostal arteries, because the hemodynamic conditions

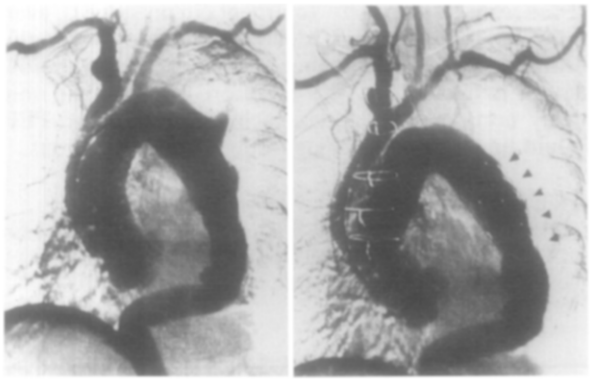

Fig. 2. Angiograms before *(left)* and after *(right)* operation. *Arrowheads* indicate the location of the stent.

around the graft are similar to those after thromboexclusion. Although there may be a limitation on indications for our method, it is a useful alternative for patients at poor risk and those with pulmonary disease.

REFERENCES

1. Borst HG, Walterbusch G, Schaps D. Extensive aortic replacement using "elephant trunk" prosthesis. Thorac Cardiovasc Surg 1983;31:37-40.
2. Borst HG, Frank G, Schapes D Treatment of extensive aortic aneurysm by a new multiple-stage approach. J Thorac Cardiovasc Surg 1988;95:11-3.
3. Crawford ES, Coselli JS, Svensson LG, Safi HJ, Hess KR. Diffuse aneurysmal disease (chronic aortic dissection, Marfan, and mega aorta syndromes) and multiple aneurysm: treatment by subtotal and total aortic replacement emphasizing the elephant trunk operation. Ann Surg 1990;211:521-37.
4. Heinemann MK, Buehner B, Jurmann MJ, Borst HG. Use of the "elephant trunk technique" in aortic surgery. Ann Thorac Surg 1995;60:2-7.

CARDIOPULMONARY BYPASS FOR HEPARIN-INDUCED THROMBOCYTOPENIA: MANAGEMENT WITH A HEPARIN-BONDED CIRCUIT AND ENOXAPARIN

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Heparin-induced thrombocytopenia (HIT) is a potentially dangerous condition in patients needing cardiac operation because the use of unfractionated, standard heparin for cardiopulmonary bypass (CPB) can cause severe bleeding, thromboembolism, and even death. Several strategies that avoid or modify the use of standard heparin have been tried in such situations but none has gained universal acceptance. We describe here the successful use of a heparin-bonded CPB circuit and enoxapa-

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